Fig. 1

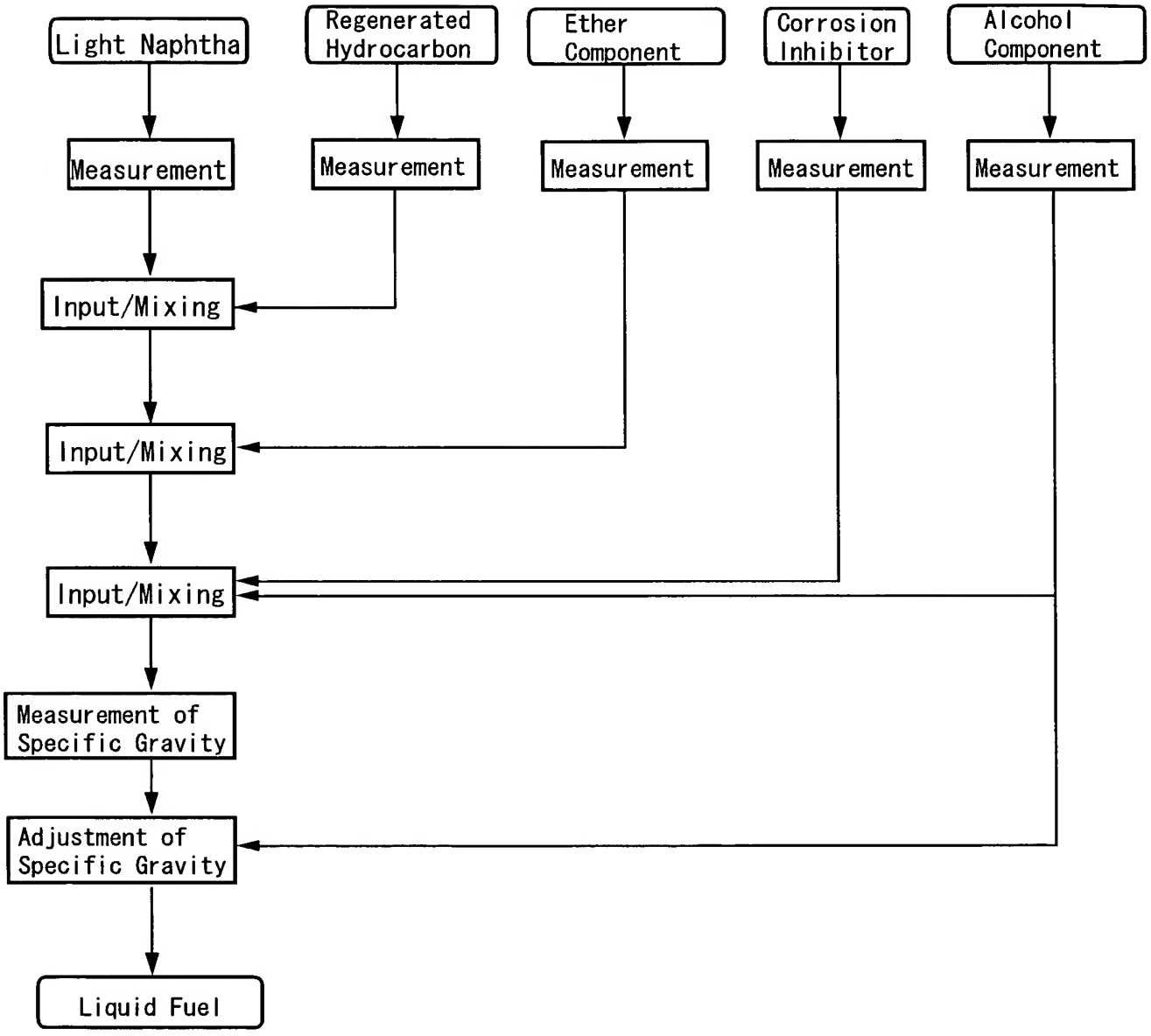
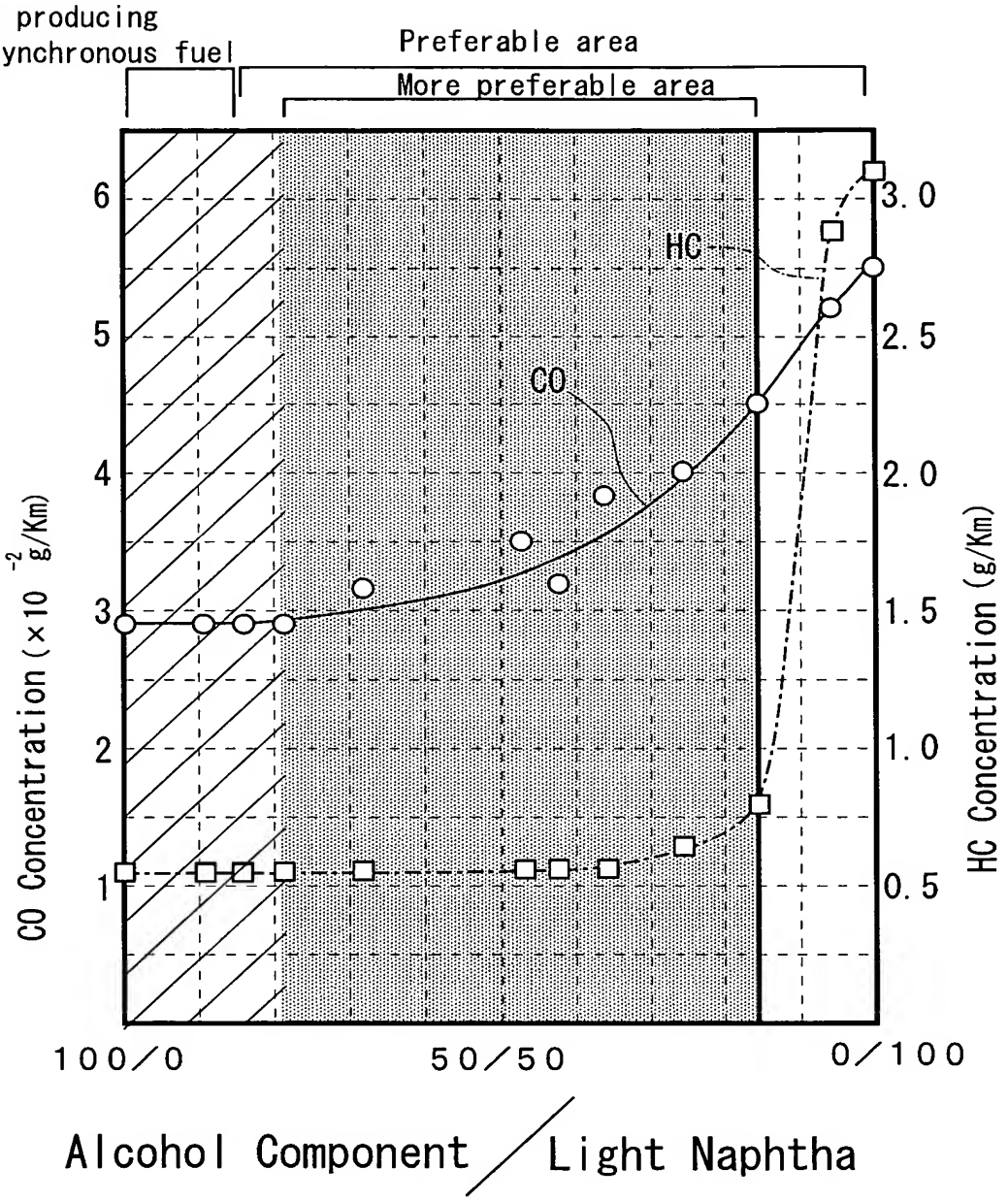

Light Naphtha
Regenerated Hydrocarbon
Ether Component
Corrosion Inhibitor
Alcohol Component
Measurement
Measurement
Measurement
Measurement
Measurement
Input/Mixing
Input/Mixing
Input/Mixing
Measurement of Specific Gravity
Adjustment of Specific Gravity
Liquid Fuel

Fig. 2



Mixing Ratio (Alcohol/Ether/Naphtha)	100/0/0	85/5/10	80/5/15	75/5/20	65/5/30	40/5/55	45/5/50	35/5/60	25/5/70	15/5/80	5/5/90	0/0/100
Ratio (Alcohol/Naphtha)	100/0	89.5/10.5	84.2/15.8	78.9/21.1	68.4/31.6	42.1/57.9	47.4/52.6	36.8/63.2	26.3/73.7	15.8/84.2	5.3/94.7	0/100
HC Concentration (g/Km)	1.120	1.121	1.121	1.122	1.126	1.129	1.129	1.143	1.253	1.578	2.889	3.054
Co Concentration (g/Km)	0.029	0.029	0.029	0.029	0.032	0.032	0.035	0.038	0.040	0.045	0.051	0.055

Fig. 3

<Ether Nonloaded Type>

Designation of Formulation	Fuel Composition						
	Naphtha	Ether	Alcohol				
			Ethanol	IPA	nBA	IBA	1-Pentanol
E2	98		2				
E10	90		10				
E20	80		20				
E50	50		50				
IN40	60			20	20		
IN15	85			10	5		
IN75	25			35	40		
EIB40	60		20			20	
EIB15	85		5			10	
EIB75	25		35			40	
PNB30	70			10	10	10	
PNB15	85			5	5	5	
PNB75	25			25	25	25	
EIPP30	70		10	10			10
EIPP15	85		5	5			5
EIPP75	25		25	25			25

<Ether Loaded Type>

Designation of Formulation	Fuel Composition						
	Naphtha	Ether	Alcohol				
			Ethanol	IPA	nBA	IBA	1-Pentanol
E10−E	85	5	10				
E20−E	70	10	20				
E50−E	20	30	50				
IN40−E	30	30		20	20		
IN15−E	80	5		10	5		
IN75−E	20	5		35	40		
EIB40−E	30	30	20			20	
EIB15−E	80	5	5			10	
EIB75−E	20	5	35			40	
PNB30−E	40	30		10	10	10	
PNB15−E	80	5		5	5	5	
PNB75−E	20	5		25	25	25	
EIPP30−E	40	30	10	10			10
EIPP15−E	80	5	5	5			5
EIPP75−E	20	5	25	25			25

Fig. 4

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
E10	90.0	10.0					None		0.0	100	120	5	100	100
	89.9	10.0					None		0.1	100	120	0	100	100
	90.0	10.0					None		0.0	120	24	100	100	100
	89.6	10.0					None		0.4	120	24	0	100	0
	89.6	10.0					None		0.5	120	24	0	0	0
E10-Me	89.6	10.0					Methanol	0.4	0.0	100	24	0	100	100
	89.6	10.0						0.5	0.0	120	24	0	100	100
E10-PG	89.6	10.0					Propylene glycol	0.4	0.0	100	24	0	100	100
	89.6	10.0						0.5	0.0	120	24	0	100	100
E10-DEK	86.9	9.7					Diethyl ketone	3.5	0.0	100	24	0	100	100
	88.6	9.8						1.5	0.1	100	24	0	100	100
	86.0	9.6						4.5	0.0	120	24	0	100	100
	88.1	9.8						2.0	0.1	120	24	0	100	100
	89.6	10.0						0.3	0.2	120	24	0	100	100
	85.1	9.5						5.0	0.4	120	24	0	100	100
	84.2	9.4						6.0	0.5	120	24	0	100	0
E10-GE	87.3	9.7					Ethyl formate	3.0	0.0	100	24	0	100	100
	88.1	9.8						2.0	0.1	100	24	0	100	100
	86.4	9.6						4.0	0.0	120	24	0	100	100
	87.2	9.7						3.0	0.1	120	24	0	100	100
	88.9	9.9						1.0	0.2	120	24	0	100	100
	84.2	9.4						6.0	0.4	120	24	0	100	100
	83.3	9.3						7.0	0.5	120	24	0	100	0
E10-PA	88.7	9.9					Propionaldehyde	1.5	0.0	100	24	0	100	100
	89.0	9.9						1.0	0.1	100	24	0	100	100
	88.2	9.8						2.0	0.0	120	24	0	100	100
	89.0	9.9						1.0	0.1	120	24	0	100	100
	89.4	9.9						0.5	0.2	120	24	0	100	100
	86.0	9.6						4.0	0.4	120	24	0	100	100
	85.1	9.5						5.0	0.5	120	24	0	100	0

*1 100 →Perfectly phase-solved. 0 →Layer-separated

Fig. 5

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol												
	Naphtha	Ethanol	NPA	IPA	NBA	IBA	Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
E20	80.0	20.0					None		0.0	100	120	7	100	100
	79.9	20.0					None		0.1	100	120	0	100	100
	80.0	20.0					None		0.0	120	24	100	100	100
	79.3	19.8					None		0.9	120	24	0	100	0
	79.1	19.8					None		1.1	120	24	0	0	0
E20-Me	79.6	19.9					Methanol	0.5	0.0	100	24	0	100	100
	79.6	19.9						0.5	0.0	120	24	0	100	100
E20-EG	79.6	19.9					Ethylene glycol	0.5	0.0	100	24	0	100	100
	79.6	19.9						0.5	0.0	120	24	0	100	100
E20-Ac	77.6	19.4					Acetone	3.0	0.0	100	24	0	100	100
	78.7	19.7						1.5	0.1	100	24	0	100	100
	76.8	19.2						4.0	0.0	120	24	0	100	100
	78.3	19.6						2.0	0.1	120	24	0	100	100
	79.6	19.9						0.3	0.2	120	24	0	100	100
	75.3	18.8						5.0	0.9	120	24	0	100	100
	73.5	18.4						7.0	1.1	120	24	0	100	0
E20-GM	75.2	18.8					Methyl formate	6.0	0.0	100	24	0	100	100
	77.5	19.4						3.0	0.1	100	24	0	100	100
	73.6	18.4						8.0	0.0	120	24	0	100	100
	76.7	19.2						4.0	0.1	120	24	0	100	100
	78.2	19.6						2.0	0.2	120	24	0	100	100
	74.5	18.6						6.0	0.9	120	24	0	100	100
	72.7	18.2						8.0	1.1	120	24	0	100	0
E20-BA	78.4	19.6					Butylaldehyde	2.0	0.0	100	24	0	100	100
	79.1	19.8						1.0	0.1	100	24	0	100	100
	78.0	19.5						2.5	0.0	120	24	0	100	100
	79.1	19.8						1.0	0.1	120	24	0	100	100
	79.4	19.9						0.5	0.2	120	24	0	100	100
	76.9	19.2						3.0	0.9	120	24	0	100	100
	75.9	19.0						4.0	1.1	120	24	0	100	0

*1 100 →Perfectly phase-solved. 0 →Layer-separated

Fig. 6

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
E50	50.0	50.0					None		0.0	100	120	100	100	100
	49.9	50.0					None		0.1	100	120	0	100	100
	50.0	50.0					None		0.0	120	24	100	100	100
	48.3	48.3					None		3.4	120	24	0	100	0
	48.2	48.2					None		3.6	120	24	0	0	0
E50-Me	49.6	49.6					Methanol	0.8	0.0	100	24	0	100	100
	49.5	49.5						1.0	0.0	120	24	0	100	100
E50-EG	49.7	49.7					Ethylene glycol	0.7	0.0	100	24	0	100	100
	49.5	49.5						1.0	0.0	120	24	0	100	100
E50-MEK	48.0	48.0					Methyl ethyl ketone	4.0	0.0	100	24	0	100	100
	49.0	49.0						2.0	0.1	100	24	0	100	100
	47.0	47.0						6.0	0.0	120	24	0	100	100
	49.0	49.0						2.0	0.1	120	24	0	100	100
	49.7	49.7						0.4	0.2	120	24	0	100	100
	45.8	45.8						5.0	3.4	120	24	0	100	100
	44.7	44.7						7.0	3.6	120	24	0	100	0
E50-GE	47.0	47.0					Ethyl formate	6.0	0.0	100	24	0	100	100
	48.5	48.5						3.0	0.1	100	24	0	100	100
	45.0	45.0						10.0	0.0	120	24	0	100	100
	47.5	47.5						5.0	0.1	120	24	0	100	100
	48.9	48.9						2.0	0.2	120	24	0	100	100
	46.3	46.3						4.0	3.4	120	24	0	100	100
	45.2	45.2						6.0	3.6	120	24	0	100	0
E50-AA	48.5	48.5					Acetaldehyde	3.0	0.0	100	24	0	100	100
	49.2	49.2						1.5	0.1	100	24	0	100	100
	48.0	48.0						4.0	0.0	120	24	0	100	100
	49.0	49.0						2.0	0.1	120	24	0	100	100
	49.4	49.4						1.0	0.2	120	24	0	100	100
	47.3	47.3						2.0	3.4	120	24	0	100	100
	46.7	46.7						3.0	3.6	120	24	0	100	0

*1 100 →Perfectly phase-solved. 0 →Layer-separated

Fig. 7

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol												
	Naphtha	Ethanol	NPA	IPA	NBA	IBA	Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
IN40	60.0			20.0	20.0		None		0.0	90	24	100	100	100
	59.9			20.0	20.0		None		0.1	90	24	0	100	100
	60.0			20.0	20.0		None		0.0	120	24	100	100	100
	57.8			19.3	19.3		None		3.6	120	24	0	100	0
	57.7			19.2	19.2		None		3.8	120	24	0	0	0
IN40-Me	59.5			19.8	19.8		Methanol	0.8	0.0	100	24	0	100	100
	59.6			19.9	19.9			0.4	0.2	100	24	0	100	100
	59.0			19.7	19.7			1.7	0.0	120	24	0	100	100
	59.3			19.8	19.8			1.0	0.2	120	24	0	100	100
	59.5			19.8	19.8			0.5	0.4	120	24	0	100	100
	57.2			19.1	19.1			1.0	3.6	120	24	0	100	100
	56.5			18.8	18.8			2.0	3.8	120	24	0	100	0
IN40-EG	59.1			19.7	19.7		Ethylene glycol	1.5	0.0	100	24	0	100	100
	59.3			19.8	19.8			1.0	0.2	100	24	0	100	100
	58.2			19.4	19.4			3.0	0.0	120	24	0	100	100
	58.7			19.6	19.6			2.0	0.2	120	24	0	100	100
	59.2			19.7	19.7			1.0	0.4	120	24	0	100	100
IN40-Ac	59.9			20.0	20.0		Acetone	0.2	0.0	100	24	0	100	100
	59.9			20.0	20.0			0.1	0.1	100	24	0	100	100
	59.9			20.0	20.0			0.2	0.0	120	24	0	100	100
	59.9			20.0	20.0			0.1	0.1	120	24	0	100	100
	56.6			18.9	18.9			2.0	3.6	120	24	0	100	100
	55.9			18.6	18.6			3.0	3.8	120	24	0	100	0
IN40-GM	59.1			19.7	19.7		Methyl formate	1.5	0.0	100	24	0	100	100
	59.5			19.8	19.8			0.8	0.1	100	24	0	100	100
	58.2			19.4	19.4			3.0	0.0	120	24	0	100	100
	59.3			19.8	19.8			1.0	0.2	120	24	0	100	100
	59.5			19.8	19.8			0.5	0.3	120	24	0	100	100
	56.6			18.9	18.9			2.0	3.6	120	24	0	100	100
	55.9			18.6	18.6			3.0	3.8	120	24	0	100	0
IN40-BA	59.8			19.9	19.9		Butylaldehyde	0.3	0.0	100	24	0	100	100
	59.8			19.9	19.9			0.2	0.1	100	24	0	100	100
	59.7			19.9	19.9			0.5	0.0	120	24	0	100	100
	59.8			19.9	19.9			0.2	0.1	120	24	0	100	100
	59.8			19.9	19.9			0.1	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 8

Designation of Formulation	Fuel Composition (wt%) HC Naphtha	Alcohol Ethanol	Alcohol NPA	Alcohol IPA	Alcohol NBA	Alcohol IBA	Additive Kind	Additive Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test Evaluation Temp. (℃)	Aluminum Corrosion Test Evaluation Time (hr)	Aluminum Corrosion Test Weight Loss Rate (%)	Stability of Fuel*1 Room Temp. 25° C	Stability of Fuel*1 Low Temp. -10° C
IN15	85.0			10.0	5.0		None		0.0	90	24	10	100	100
	84.9			10.0	5.0		None		0.1	90	24	0	100	100
	85.0			10.0	5.0		None		0.0	120	24	100	100	100
	84.5			9.9	5.0		None		0.6	120	24	0	100	0
	84.3			9.9	5.0		None		0.8	120	24	0	0	0
IN15-Me	84.6			10.0	5.0		Methanol	0.5	0.0	100	24	0	100	100
	84.6			10.0	5.0			0.3	0.2	100	24	0	100	100
	83.7			9.9	4.9			1.5	0.0	120	24	0	100	100
	84.2			9.9	5.0			0.8	0.2	120	24	0	100	100
	84.3			9.9	5.0			0.5	0.3	120	24	0	100	100
	84.1			9.9	4.9			0.5	0.6	120	24	0	100	100
	83.5			9.8	4.9			1.0	0.8	120	24	0	100	0
IN15-PG	83.3			9.8	4.9		Propylene glycol	2.0	0.0	100	24	0	100	100
	84.0			9.9	4.9			1.0	0.2	100	24	0	100	100
	81.6			9.6	4.8			4.0	0.0	120	24	0	100	100
	83.1			9.8	4.9			2.0	0.2	120	24	0	100	100
	83.8			9.9	4.9			1.0	0.4	120	24	0	100	100
IN15-MBK	84.7			10.0	5.0		Methyl isobutyl ketone	0.3	0.0	100	24	0	100	100
	84.7			10.0	5.0			0.2	0.1	100	24	0	100	100
	84.6			10.0	5.0			0.5	0.0	120	24	0	100	100
	84.7			10.0	5.0			0.2	0.1	120	24	0	100	100
	84.1			9.9	4.9			0.5	0.6	120	24	0	100	100
	83.5			9.8	4.9			1.0	0.8	120	24	0	100	0
IN15-GE	84.2			9.9	5.0		Ethyl formate	1.0	0.0	100	24	0	100	100
	84.4			9.9	5.0			0.6	0.1	100	24	0	100	100
	80.8			9.5	4.8			5.0	0.0	120	24	0	100	100
	83.1			9.8	4.9			2.0	0.2	120	24	0	100	100
	83.8			9.9	4.9			1.0	0.4	120	24	0	100	100
	81.1			9.5	4.8			4.0	0.6	120	24	0	100	100
	80.1			9.4	4.7			5.0	0.8	120	24	0	100	0
IN15-PA	84.8			10.0	5.0		Propionaldehyde	0.2	0.0	100	24	0	100	100
	84.8			10.0	5.0			0.1	0.1	100	24	0	100	100
	84.7			10.0	5.0			0.4	0.0	120	24	0	100	100
	84.7			10.0	5.0			0.2	0.1	120	24	0	100	100
	84.7			10.0	5.0			0.1	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 9

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
IN75	25.0			35.0	40.0		None		0.0	90	24	100	100	100
	25.0			35.0	40.0		None		0.1	90	24	100	100	100
	25.0			34.9	39.9		None		0.2	90	24	0	100	100
	25.0			35.0	40.0		None		0.0	120	24	100	100	100
	24.9			34.8	39.8		None		0.6	120	24	100	100	100
	24.8			34.7	39.7		None		0.8	120	24	0	100	100
IN75-Me	24.8			34.7	39.6		Methanol	1.0	0.0	100	24	0	100	100
	24.8			34.7	39.7			0.5	0.3	100	24	0	100	100
	24.5			34.3	39.2			2.0	0.0	120	24	0	100	100
	24.7			34.5	39.5			1.0	0.3	120	24	0	100	100
	24.8			34.7	39.6			0.5	0.5	120	24	0	100	100
IN75-EG	24.3			34.0	38.8		Ethylene glycol	3.0	0.0	100	24	0	100	100
	24.4			34.2	39.1			2.0	0.3	100	24	0	100	100
	23.5			32.9	37.6			6.0	0.0	120	24	0	100	100
	23.9			33.5	38.3			4.0	0.3	120	24	0	100	100
	24.4			34.1	39.0			2.0	0.5	120	24	0	100	100
IN75-MPK	25.0			34.9	39.9		Methyl-n-propyl ketone	0.2	0.0	100	24	0	100	100
	25.0			34.9	39.9			0.1	0.1	100	24	0	100	100
	25.0			34.9	39.9			0.2	0.0	120	24	0	100	100
	25.0			34.9	39.9			0.1	0.1	120	24	0	100	100
IN75-GE	24.5			34.3	39.2		Methyl formate	2.0	0.0	100	24	0	100	100
	24.7			34.6	39.6			1.0	0.1	100	24	0	100	100
	24.1			33.8	38.6			3.5	0.0	120	24	0	100	100
	24.6			34.4	39.3			1.5	0.2	120	24	0	100	100
	24.7			34.6	39.6			0.8	0.3	120	24	0	100	100
IN75-AA	24.9			34.9	39.9		Acetaldehyde	0.3	0.0	100	24	0	100	100
	24.9			34.9	39.9			0.2	0.1	100	24	0	100	100
	24.9			34.8	39.8			0.6	0.0	120	24	0	100	100
	24.9			34.9	39.8			0.3	0.1	120	24	0	100	100
	24.9			34.9	39.8			0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 10

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
EIB40	60.0	20.0				20.0	None		0.0	90	24	100	100	100
	59.9	20.0				20.0	None		0.1	90	24	0	100	100
	60.0	20.0				20.0	None		0.0	120	24	100	100	100
	57.1	19.0				19.0	None		4.8	120	24	0	100	0
	56.9	19.0				19.0	None		5.1	120	24	0	0	0
EIB40-Me	59.1	19.7				19.7	Methanol	1.5	0.0	100	24	0	100	100
	59.2	19.7				19.7		0.8	0.5	100	24	0	100	100
	58.8	19.6				19.6		2.0	0.0	120	24	0	100	100
	59.1	19.7				19.7		1.0	0.5	120	24	0	100	100
	59.1	19.7				19.7		0.5	1.0	120	24	0	100	100
EIB40-EG	59.4	19.8				19.8	Ethylene glycol	1.0	0.0	100	24	0	100	100
	59.3	19.8				19.8		0.7	0.4	100	24	0	100	100
	58.8	19.6				19.6		2.0	0.0	120	24	0	100	100
	58.9	19.6				19.6		1.5	0.3	120	24	0	100	100
	59.1	19.7				19.7		1.0	0.5	120	24	0	100	100
EIB40-Ac	59.9	20.0				20.0	Acetone	0.2	0.0	100	24	0	100	100
	59.9	20.0				20.0		0.1	0.1	100	24	0	100	100
	58.2	19.4				19.4		3.0	0.0	120	24	0	100	100
	59.3	19.8				19.8		1.0	0.2	120	24	0	100	100
	59.6	19.9				19.9		0.2	0.5	120	24	0	100	100
	55.3	18.4				18.4		3.0	4.8	120	24	0	100	100
	54.5	18.2				18.2		4.0	5.1	120	24	0	100	0
EIB40-GM	58.5	19.5				19.5	Methyl formate	2.5	0.0	100	24	0	100	100
	59.0	19.7				19.7		1.5	0.2	100	24	0	100	100
	57.0	19.0				19.0		5.0	0.0	120	24	0	100	100
	58.7	19.6				19.6		2.0	0.2	120	24	0	100	100
	59.1	19.7				19.7		1.0	0.5	120	24	0	100	100
	55.9	18.6				18.6		2.0	4.8	120	24	0	100	100
	55.1	18.4				18.4		3.0	5.1	120	24	0	100	0
EIB40-BA	59.6	19.9				19.9	Butylaldehyde	0.6	0.0	100	24	0	100	100
	59.6	19.9				19.9		0.1	0.5	100	24	0	100	100
	59.4	19.8				19.8		1.0	0.0	120	24	0	100	100
	59.6	19.9				19.9		0.2	0.5	120	24	0	100	100
	59.3	19.8				19.8		0.1	1.0	120	24	0	100	100
	56.5	18.8				18.8		1.0	4.8	120	24	0	100	100
	55.7	18.6				18.6		2.0	5.1	120	24	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 11

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
EIB15	85.0	5.0				10.0	None		0.0	90	24	28	100	100
	84.9	5.0				10.0	None		0.1	90	24	0	100	100
	85.0	5.0				10.0	None		0.0	120	24	100	100	100
	84.5	5.0				9.9	None		0.6	120	24	0	100	0
	84.3	5.0				9.9	None		0.8	120	24	0	0	0
EIB15-Me	84.2	5.0				9.9	Methanol	1.0	0.0	100	24	0	100	100
	84.3	5.0				9.9		0.5	0.3	100	24	0	100	100
	83.7	4.9				9.9		1.5	0.0	120	24	0	100	100
	84.0	4.9				9.9		0.8	0.4	120	24	0	100	100
	84.0	4.9				9.9		0.6	0.6	120	24	0	100	100
	83.0	4.9				9.8		1.5	0.8	120	24	0	100	0
EIB15-PG	83.7	4.9				9.9	Propylene glycol	1.5	0.0	100	24	0	100	100
	84.2	5.0				9.9		0.8	0.2	100	24	0	100	100
	82.5	4.9				9.7		3.0	0.0	120	24	0	100	100
	83.0	4.9				9.8		2.0	0.3	120	24	0	100	100
	83.7	4.9				9.9		1.0	0.5	120	24	0	100	100
EIB15-DEK	84.2	5.0				9.9	Diethyl ketone	1.0	0.0	100	24	0	100	100
	84.6	5.0				10.0		0.4	0.1	100	24	0	100	100
	83.7	4.9				9.9		1.5	0.0	120	24	0	100	100
	84.3	5.0				9.9		0.7	0.1	120	24	0	100	100
	84.6	5.0				10.0		0.2	0.3	120	24	0	100	100
	82.4	4.8				9.7		2.5	0.6	120	24	0	100	100
	81.3	4.8				9.6		3.5	0.8	120	24	0	100	0
EIB15-SM	83.3	4.9				9.8	Methyl acetate	2.0	0.0	100	24	0	100	100
	83.9	4.9				9.9		1.0	0.3	100	24	0	100	100
	82.5	4.9				9.7		3.0	0.0	120	24	0	100	100
	83.6	4.9				9.8		1.5	0.2	120	24	0	100	100
	84.0	4.9				9.9		0.7	0.5	120	24	0	100	100
	81.9	4.8				9.6		3.0	0.6	120	24	0	100	100
	80.9	4.8				9.5		4.0	0.8	120	24	0	100	0
EIB15-PA	84.5	5.0				9.9	Propionaldehyde	0.6	0.0	100	24	0	100	100
	84.7	5.0				10.0		0.1	0.3	100	24	0	100	100
	84.2	5.0				9.9		1.0	0.0	120	24	0	100	100
	84.5	5.0				9.9		0.4	0.2	120	24	0	100	100
	84.5	5.0				9.9		0.2	0.4	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 12

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol												
	Naphtha	Ethanol	NPA	IPA	NBA	IBA		Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
EIB75	25.0	35.0				40.0	None		0.0	90	24	100	100	100
	25.0	34.9				40.0	None		0.1	90	24	100	100	100
	25.0	34.9				39.9	None		0.2	90	24	0	100	100
	25.0	35.0				40.0	None		0.0	120	24	100	100	100
	24.8	34.7				39.6	None		1.0	120	24	100	100	100
	24.7	34.6				39.5	None		1.2	120	24	0	100	100
EIB75-Me	24.6	34.5				39.4	Methanol	1.5	0.0	100	24	0	100	100
	24.6	34.5				39.4		1.0	0.5	100	24	0	100	100
	24.5	34.3				39.2		2.0	0.0	120	24	0	100	100
	24.5	34.3				39.2		1.5	0.5	120	24	0	100	100
	24.5	34.3				39.2		1.0	1.0	120	24	0	100	100
EIB75-EG	24.3	34.0				38.8	Ethylene glycol	3.0	0.0	100	24	0	100	100
	24.5	34.3				39.2		1.5	0.4	100	24	0	100	100
	23.8	33.3				38.0		5.0	0.0	120	24	0	100	100
	24.2	33.8				38.7		3.0	0.3	120	24	0	100	100
	24.4	34.1				39.0		2.0	0.5	120	24	0	100	100
EIB75-MEK	24.3	34.0				38.8	Methyl ethyl ketone	3.0	0.0	100	24	0	100	100
	24.9	34.8				39.8		0.3	0.3	100	24	0	100	100
	23.8	33.3				38.0		5.0	0.0	120	24	0	100	100
	24.5	34.2				39.1		2.0	0.2	120	24	0	100	100
	24.7	34.6				39.5		0.2	1.0	120	24	0	100	100
EIB75-GM	24.0	33.6				38.4	Methyl formate	4.0	0.0	100	24	0	100	100
	24.4	34.2				39.1		2.0	0.3	100	24	0	100	100
	23.0	32.2				36.8		8.0	0.0	120	24	0	100	100
	23.9	33.5				38.3		4.0	0.3	120	24	0	100	100
	24.4	34.1				39.0		2.0	0.5	120	24	0	100	100
EIB75-AA	24.8	34.7				39.7	Acetaldehyde	0.8	0.0	100	24	0	100	100
	24.9	34.8				39.8		0.2	0.3	100	24	0	100	100
	24.8	34.7				39.6		1.0	0.0	120	24	0	100	100
	24.8	34.8				39.7		0.4	0.3	120	24	0	100	100
	24.8	34.8				39.7		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 13

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp.(℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
PNB30	70.0			10.0	10.0	10.0	None		0.0	80	120	19	100	100
	69.9			10.0	10.0	10.0	None		0.1	80	120	0	100	100
	70.0			10.0	10.0	10.0	None		0.0	120	24	100	100	100
	68.7			9.8	9.8	9.8	None		1.8	120	24	0	100	0
	68.6			9.8	9.8	9.8	None		2.0	120	24	0	0	0
PNB30-Me	69.3			9.9	9.9	9.9	Methanol	1.0	0.0	100	24	0	100	100
	69.5			9.9	9.9	9.9		0.4	0.3	100	24	0	100	100
	69.0			9.9	9.9	9.9		1.5	0.0	120	24	0	100	100
	69.2			9.9	9.9	9.9		1.0	0.2	120	24	0	100	100
	69.4			9.9	9.9	9.9		0.5	0.3	120	24	0	100	100
	68.0			9.7	9.7	9.7		1.0	1.8	120	24	0	100	100
	67.2			9.6	9.6	9.6		2.0	2.0	120	24	0	100	0
PNB30-EG	68.6			9.8	9.8	9.8	Ethylene glycol	2.0	0.0	100	24	0	100	100
	69.2			9.9	9.9	9.9		1.0	0.2	100	24	0	100	100
	68.3			9.8	9.8	9.8		2.5	0.0	120	24	0	100	100
	68.8			9.8	9.8	9.8		1.5	0.2	120	24	0	100	100
	69.1			9.9	9.9	9.9		1.0	0.3	120	24	0	100	100
PNB30-Ac	69.9			10.0	10.0	10.0	Acetone	0.2	0.0	100	24	0	100	100
	69.9			10.0	10.0	10.0		0.1	0.1	100	24	0	100	100
	69.9			10.0	10.0	10.0		0.2	0.0	120	24	0	100	100
	69.9			10.0	10.0	10.0		0.1	0.1	120	24	0	100	100
	67.3			9.6	9.6	9.6		2.0	1.8	120	24	0	100	100
	66.5			9.5	9.5	9.5		3.0	2.0	120	24	0	100	0
PNB30-GM	69.0			9.9	9.9	9.9	Methyl formate	1.5	0.0	100	24	0	100	100
	69.2			9.9	9.9	9.9		1.0	0.2	100	24	0	100	100
	68.3			9.8	9.8	9.8		2.5	0.0	120	24	0	100	100
	68.8			9.8	9.8	9.8		1.5	0.2	120	24	0	100	100
	69.4			9.9	9.9	9.9		0.6	0.3	120	24	0	100	100
	66.6			9.5	9.5	9.5		3.0	1.8	120	24	0	100	100
	65.5			9.4	9.4	9.4		4.5	2.0	120	24	0	100	0
PNB30-BA	69.7			10.0	10.0	10.0	Acetaldehyde	0.4	0.0	100	24	0	100	100
	69.8			10.0	10.0	10.0		0.1	0.2	100	24	0	100	100
	69.7			10.0	10.0	10.0		0.5	0.0	120	24	0	100	100
	69.7			10.0	10.0	10.0		0.2	0.3	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 14

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
PNB15	85.0			5.0	5.0	5.0	None		0.0	80	120	1	100	100
	84.9			5.0	5.0	5.0	None		0.1	80	120	0	100	100
	85.0			5.0	5.0	5.0	None		0.0	120	24	100	100	100
	84.6			5.0	5.0	5.0	None		0.5	120	24	0	100	0
	84.4			5.0	5.0	5.0	None		0.7	120	24	0	0	0
PNB15-Me	84.3			5.0	5.0	5.0	Methanol	0.8	0.0	100	24	0	100	100
	84.5			5.0	5.0	5.0		0.4	0.2	100	24	0	100	100
	83.7			4.9	4.9	4.9		1.5	0.0	120	24	0	100	100
	84.0			4.9	4.9	4.9		1.0	0.2	120	24	0	100	100
	84.3			5.0	5.0	5.0		0.5	0.3	120	24	0	100	100
	82.9			4.9	4.9	4.9		2.0	0.5	120	24	0	100	100
	81.9			4.8	4.8	4.8		3.0	0.7	120	24	0	100	0
PNB15-PG	82.5			4.9	4.9	4.9	Propylene glycol	3.0	0.0	100	24	0	100	100
	83.6			4.9	4.9	4.9		1.5	0.2	100	24	0	100	100
	81.6			4.8	4.8	4.8		4.0	0.0	120	24	0	100	100
	83.1			4.9	4.9	4.9		2.0	0.2	120	24	0	100	100
	83.9			4.9	4.9	4.9		1.0	0.3	120	24	0	100	100
PNB15-MPK	84.7			5.0	5.0	5.0	Methyl-n-propyl ketone	0.3	0.0	100	24	0	100	100
	84.7			5.0	5.0	5.0		0.2	0.1	100	24	0	100	100
	84.6			5.0	5.0	5.0		0.5	0.0	120	24	0	100	100
	84.7			5.0	5.0	5.0		0.2	0.2	120	24	0	100	100
	81.2			4.8	4.8	4.8		4.0	0.5	120	24	0	100	100
	80.2			4.7	4.7	4.7		5.0	0.7	120	24	0	100	0
PNB15-SM	83.7			4.9	4.9	4.9	Methyl acetate	1.5	0.0	100	24	0	100	100
	84.0			4.9	4.9	4.9		1.0	0.2	100	24	0	100	100
	79.9			4.7	4.7	4.7		6.0	0.0	120	24	0	100	100
	82.3			4.8	4.8	4.8		3.0	0.2	120	24	0	100	100
	83.9			4.9	4.9	4.9		1.0	0.3	120	24	0	100	100
	79.5			4.7	4.7	4.7		6.0	0.5	120	24	0	100	100
	78.5			4.6	4.6	4.6		7.0	0.7	120	24	0	100	0
PNB15-AA	84.7			5.0	5.0	5.0	Acetaldehyde	0.3	0.0	100	24	0	100	100
	84.7			5.0	5.0	5.0		0.2	0.1	100	24	0	100	100
	84.6			5.0	5.0	5.0		0.5	0.0	120	24	0	100	100
	84.7			5.0	5.0	5.0		0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 15

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
PNB75	25.0			25.0	25.0	25.0	None		0.0	80	120	100	100	100
	25.0			24.9	25.0	25.0	None		0.1	80	120	85	100	100
	25.0			24.9	24.9	25.0	None		0.2	80	120	0	100	100
	25.0			25.0	25.0	25.0	None		0.0	120	24	100	100	100
	22.5			22.5	22.5	22.5	None		10.0	120	24	0	100	0
	22.4			22.4	22.4	22.4	None		10.5	120	24	0	0	0
PNB75-Me	24.8			24.8	24.8	24.8	Methanol	1.0	0.0	100	24	0	100	100
	24.8			24.8	24.8	24.8		0.4	0.3	100	24	0	100	100
	24.5			24.5	24.5	24.5		2.0	0.0	120	24	0	100	100
	24.6			24.6	24.6	24.6		1.5	0.2	120	24	0	100	100
	24.7			24.7	24.7	24.7		0.8	0.4	120	24	0	100	100
	22.0			22.0	22.0	22.0		2.0	10.0	120	24	0	100	100
	21.6			21.6	21.6	21.6		3.0	10.5	120	24	0	100	0
PNB75-EG	24.0			24.0	24.0	24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100
	24.4			24.4	24.4	24.4		2.0	0.3	100	24	0	100	100
	23.5			23.5	23.5	23.5		6.0	0.0	120	24	0	100	100
	24.2			24.2	24.2	24.2		3.0	0.3	120	24	0	100	100
	24.4			24.4	24.4	24.4		2.0	0.4	120	24	0	100	100
PNB75-MEK	24.9			24.9	24.9	24.9	Methyl etyhl ketone	0.3	0.0	100	24	0	100	100
	24.9			24.9	24.9	24.9		0.1	0.2	100	24	0	100	100
	24.9			24.9	24.9	24.9		0.5	0.0	120	24	0	100	100
	24.9			24.9	24.9	24.9		0.2	0.2	120	24	0	100	100
	21.8			21.8	21.8	21.8		3.0	10.0	120	24	0	100	100
	21.4			21.4	21.4	21.4		4.0	10.5	120	24	0	100	0
PNB75-GE	24.0			24.0	24.0	24.0	Ethyl formate	4.0	0.0	100	24	0	100	100
	24.5			24.5	24.5	24.5		2.0	0.2	100	24	0	100	100
	23.5			23.5	23.5	23.5		6.0	0.0	120	24	0	100	100
	24.2			24.2	24.2	24.2		3.0	0.2	120	24	0	100	100
	24.7			24.7	24.7	24.7		1.0	0.4	120	24	0	100	100
	21.5			21.5	21.5	21.5		4.0	10.0	120	24	0	100	100
	21.1			21.1	21.1	21.1		5.0	10.5	120	24	0	100	0
PNB75-PA	24.9			24.9	24.9	24.9	Propionaldehyde	0.3	0.0	100	24	0	100	100
	24.9			24.9	24.9	24.9		0.1	0.2	100	24	0	100	100
	24.9			24.9	24.9	24.9		0.5	0.0	120	24	0	100	100
	24.9			24.9	24.9	24.9		0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 16

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
		Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA									
EIPP30	70.0	10.0		10.0		10.0	None		0.0	80	120	51	100	100
	69.9	10.0		10.0		10.0	None		0.1	80	120	0	100	100
	70.0	10.0		10.0		10.0	None		0.0	120	24	100	100	100
	68.3	9.8		9.8		9.8	None		2.5	120	24	0	100	0
	67.9	9.7		9.7		9.7	None		3.0	120	24	0	0	0
EIPP30-Me	69.0	9.9		9.9		9.9	Methanol	1.5	0.0	100	24	0	100	100
	69.4	9.9		9.9		9.9		0.5	0.4	100	24	0	100	100
	68.3	9.8		9.8		9.8		2.5	0.0	120	24	0	100	100
	68.6	9.8		9.8		9.8		1.5	0.5	120	24	0	100	100
	69.0	9.9		9.9		9.9		0.5	1.0	120	24	0	100	100
EIPP30-EG	68.6	9.8		9.8		9.8	Ethylene glycol	2.0	0.0	100	24	0	100	100
	69.0	9.9		9.9		9.9		1.0	0.4	100	24	0	100	100
	66.5	9.5		9.5		9.5		5.0	0.0	120	24	0	100	100
	67.5	9.6		9.6		9.6		3.0	0.6	120	24	0	100	100
	67.9	9.7		9.7		9.7		2.0	1.0	120	24	0	100	100
EIPP30-Ac	67.9	9.7		9.7		9.7	Acetone	3.0	0.0	100	24	0	100	100
	69.7	10.0		10.0		10.0		0.2	0.3	100	24	0	100	100
	67.2	9.6		9.6		9.6		4.0	0.0	120	24	0	100	100
	69.2	9.9		9.9		9.9		1.0	0.2	120	24	0	100	100
								0.2	0.5	120	24	0	100	100
	64.1	9.2		9.2		9.2		6.0	2.5	120	24	0	100	100
	63.0	9.0		9.0		9.0		7.0	3.0	120	24	0	100	0
EIPP30-GM	69.0	9.9		9.9		9.9	Methyl formate	1.5	0.0	100	24	0	100	100
	69.2	9.9		9.9		9.9		1.0	0.2	100	24	0	100	100
	65.8	9.4		9.4		9.4		6.0	0.0	120	24	0	100	100
	69.0	9.9		9.9		9.9		1.0	0.5	120	24	0	100	100
	69.2	9.9		9.9		9.9		0.2	1.0	120	24	0	100	100
	63.4	9.1		9.1		9.1		7.0	2.5	120	24	0	100	100
	62.3	8.9		8.9		8.9		8.0	3.0	120	24	0	100	0
EIPP30-BA	69.6	9.9		9.9		9.9	Butylaldehyde	0.6	0.0	100	24	0	100	100
	69.7	10.0		10.0		10.0		0.2	0.3	100	24	0	100	100
	69.3	9.9		9.9		9.9		1.0	0.0	120	24	0	100	100
	69.5	9.9		9.9		9.9		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 17

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA									
EIPP15	85.0	5.0		5.0		5.0	None		0.0	80	120	16	100	100
	84.9	5.0		5.0		5.0	None		0.1	80	120	0	100	100
	85.0	5.0		5.0		5.0	None		0.0	120	24	100	100	100
	84.3	5.0		5.0		5.0	None		0.8	120	24	0	100	0
	84.2	5.0		5.0		5.0	None		1.0	120	24	0	0	0
EIPP15-Me	84.2	5.0		5.0		5.0	Methanol	1.0	0.0	100	24	0	100	100
	84.2	5.0		5.0		5.0		0.5	0.4	100	24	0	100	100
	83.3	4.9		4.9		4.9		2.0	0.0	120	24	0	100	100
	83.8	4.9		4.9		4.9		1.0	0.4	120	24	0	100	100
	84.1	4.9		4.9		4.9		0.5	0.6	120	24	0	100	100
EIPP15-PG	82.9	4.9		4.9		4.9	Propylene glycol	2.5	0.0	100	24	0	100	100
	83.5	4.9		4.9		4.9		1.5	0.3	100	24	0	100	100
	81.6	4.8		4.8		4.8		4.0	0.0	120	24	0	100	100
	83.0	4.9		4.9		4.9		2.0	0.4	120	24	0	100	100
	83.3	4.9		4.9		4.9		1.5	0.5	120	24	0	100	100
EIPP15-DEK	83.3	4.9		4.9		4.9	Diethyl ketone	2.0	0.0	100	24	0	100	100
	84.6	5.0		5.0		5.0		0.2	0.3	100	24	0	100	100
	82.5	4.9		4.9		4.9		3.0	0.0	120	24	0	100	100
	84.2	5.0		5.0		5.0		0.8	0.2	120	24	0	100	100
	84.4	5.0		5.0		5.0		0.2	0.5	120	24	0	100	100
	80.9	4.8		4.8		4.8		4.0	0.8	120	24	0	100	100
	79.9	4.7		4.7		4.7		5.0	1.0	120	24	0	100	0
EIPP15-SM	84.0	4.9		4.9		4.9	Methyl acetate	1.2	0.0	100	24	0	100	100
	84.2	5.0		5.0		5.0		0.7	0.2	100	24	0	100	100
	81.6	4.8		4.8		4.8		4.0	0.0	120	24	0	100	100
	83.8	4.9		4.9		4.9		1.0	0.4	120	24	0	100	100
	84.2	5.0		5.0		5.0		0.2	0.8	120	24	0	100	100
	80.1	4.7		4.7		4.7		5.0	0.8	120	24	0	100	100
	79.1	4.7		4.7		4.7		6.0	1.0	120	24	0	100	0
EIPP15-PA	84.6	5.0		5.0		5.0	Propinaldehyde	0.5	0.0	100	24	0	100	100
	84.6	5.0		5.0		5.0		0.2	0.3	100	24	0	100	100
	84.3	5.0		5.0		5.0		0.8	0.0	120	24	0	100	100
	84.5	5.0		5.0		5.0		0.2	0.4	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 18

Designation of Formulation	Fuel Composition (wt%)						Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA									
EIPP75	25.0	25.0		25.0		25.0	None		0.0	80	120	100	100	100
	25.0	24.9		25.0		25.0	None		0.1	80	120	55	100	100
	25.0	24.9		24.9		25.0	None		0.2	80	120	0	100	100
	25.0	25.0		25.0		25.0	None		0.0	120	24	100	100	100
	24.6	24.6		24.6		24.6	None		1.5	120	24	100	100	100
	24.6	24.6		24.6		24.6	None		1.7	120	24	0	100	100
EIPP75-Me	24.5	24.5		24.5		24.5	Methanol	2.0	0.0	100	24	0	100	100
	24.6	24.6		24.6		24.6		1.0	0.5	100	24	0	100	100
	24.3	24.3		24.3		24.3		3.0	0.0	120	24	0	100	100
	24.4	24.4		24.4		24.4		2.0	0.5	120	24	0	100	100
	24.6	24.6		24.6		24.6		0.6	1.0	120	24	0	100	100
EIPP75-EG	24.0	24.0		24.0		24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100
	24.4	24.4		24.4		24.4		2.0	0.5	100	24	0	100	100
	23.0	23.0		23.0		23.0		8.0	0.0	120	24	0	100	100
	23.6	23.6		23.6		23.6		5.0	0.5	120	24	0	100	100
	24.0	24.0		24.0		24.0		3.0	1.0	120	24	0	100	100
EIPP75-MEK	24.3	24.3		24.3		24.3	Methy ethyl ketone	3.0	0.0	100	24	0	100	100
	24.9	24.9		24.9		24.9		0.2	0.3	100	24	0	100	100
	23.8	23.8		23.8		23.8		5.0	0.0	120	24	0	100	100
	24.7	24.7		24.7		24.7		1.0	0.2	120	24	0	100	100
	24.8	24.8		24.8		24.8		0.2	0.5	120	24	0	100	100
EIPP75-GM	24.3	24.3		24.3		24.3	Methyl formate	3.0	0.0	100	24	0	100	100
	24.4	24.4		24.4		24.4		2.0	0.4	100	24	0	100	100
	22.8	22.8		22.8		22.8		9.0	0.0	120	24	0	100	100
	24.4	24.4		24.4		24.4		2.0	0.5	120	24	0	100	100
	24.6	24.6		24.6		24.6		0.5	1.0	120	24	0	100	100
EIPP75-AA	24.9	24.9		24.9		24.9	Acetaldehyde	0.5	0.0	100	24	0	100	100
	24.9	24.9		24.9		24.9		0.2	0.2	100	24	0	100	100
	24.8	24.8		24.8		24.8		1.0	0.0	120	24	0	100	100
	24.8	24.8		24.8		24.8		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 19

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
E10-E	85.0	5.0	10.0					None		0.0	100	120	2	100	100
	84.9	5.0	10.0					None		0.1	100	120	0	100	100
	85.0	5.0	10.0					None		0.0	120	24	89	100	100
	84.7	5.0	10.0					None		0.4	120	24	0	100	0
	84.6	5.0	10.0					None		0.5	120	24	0	0	0
E10-E-Me	84.7	5.0	10.0					Methanol	0.4	0.0	100	24	0	100	100
	84.6	5.0	10.0						0.5	0.0	120	24	0	100	100
E10-E-PG	84.7	5.0	10.0					Propylene glycol	0.4	0.0	100	24	0	100	100
	84.6	5.0	10.0						0.5	0.0	120	24	0	100	100
E10-E-DEK	82.0	4.8	9.7					Diethyl ketone	3.5	0.0	100	24	0	100	100
	83.6	4.9	9.8						1.5	0.1	100	24	0	100	100
	81.2	4.8	9.6						4.5	0.0	120	24	0	100	100
	83.2	4.9	9.8						2.0	0.1	120	24	0	100	100
	84.6	5.0	10.0						0.3	0.2	120	24	0	100	100
	80.4	4.7	9.5						5.0	0.4	120	24	0	100	100
	79.5	4.7	9.4						6.0	0.5	120	24	0	100	0
E10-E-GE	82.5	4.9	9.7					Ethyl formate	3.0	0.0	100	24	0	100	100
	83.2	4.9	9.8						2.0	0.1	100	24	0	100	100
	81.6	4.8	9.6						4.0	0.0	120	24	0	100	100
	82.4	4.8	9.7						3.0	0.1	120	24	0	100	100
	84.0	4.9	9.9						1.0	0.2	120	24	0	100	100
	79.6	4.7	9.4						6.0	0.4	120	24	0	100	100
	78.6	4.6	9.3						7.0	0.5	120	24	0	100	0
E10-E-PA	83.7	4.9	9.9					Propionaldehyde	1.5	0.0	100	24	0	100	100
	84.1	4.9	9.9						1.0	0.1	100	24	0	100	100
	83.3	4.9	9.8						2.0	0.0	120	24	0	100	100
	84.1	4.9	9.9						1.0	0.1	120	24	0	100	100
	84.4	5.0	9.9						0.5	0.2	120	24	0	100	100
	81.3	4.8	9.6						4.0	0.4	120	24	0	100	100
	80.3	4.7	9.5						5.0	0.5	120	24	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 20

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
E20-E	70.0	10.0	20.0					None		0.0	100	120	8	100	100
	69.9	10.0	20.0					None		0.1	100	120	0	100	100
	70.0	10.0	20.0					None		0.0	120	24	100	100	100
	69.0	9.9	19.7					None		1.5	120	24	0	100	0
	68.8	9.8	19.7					None		1.7	120	24	0	0	0
E20-E-Me	69.7	10.0	19.9					Methanol	0.5	0.0	100	24	0	100	100
	69.7	10.0	19.9						0.5	0.0	120	24	0	100	100
E20-E-EG	69.7	10.0	19.9					Ethylene glycol	0.5	0.0	100	24	0	100	100
	69.7	10.0	19.9						0.5	0.0	120	24	0	100	100
E20-E-Ac	67.9	9.7	19.4					Acetone	3.0	0.0	100	24	0	100	100
	68.9	9.8	19.7						1.5	0.1	100	24	0	100	100
	67.2	9.6	19.2						4.0	0.0	120	24	0	100	100
	68.5	9.8	19.6						2.0	0.1	120	24	0	100	100
	69.7	10.0	19.9						0.3	0.2	120	24	0	100	100
	65.5	9.4	18.7						5.0	1.5	120	24	0	100	100
	63.9	9.1	18.3						7.0	1.7	120	24	0	100	0
E20-E-GM	65.8	9.4	18.8					Methyl formate	6.0	0.0	100	24	0	100	100
	67.8	9.7	19.4						3.0	0.1	100	24	0	100	100
	64.4	9.2	18.4						8.0	0.0	120	24	0	100	100
	67.1	9.6	19.2						4.0	0.1	120	24	0	100	100
	68.5	9.8	19.6						2.0	0.2	120	24	0	100	100
	64.8	9.3	18.5						6.0	1.5	120	24	0	100	100
	63.2	9.0	18.1						8.0	1.7	120	24	0	100	0
E20-E-BA	68.6	9.8	19.6					Butylaldehyde	2.0	0.0	100	24	0	100	100
	69.2	9.9	19.8						1.0	0.1	100	24	0	100	100
	68.3	9.8	19.5						2.5	0.0	120	24	0	100	100
	69.2	9.9	19.8						1.0	0.1	120	24	0	100	100
	69.5	9.9	19.9						0.5	0.2	120	24	0	100	100
	66.9	9.6	19.1						3.0	1.5	120	24	0	100	100
	66.0	9.4	18.9						4.0	1.7	120	24	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 21

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether ETBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
E50-E	20.0	30.0	50.0					None		0.0	100	120	81	100	100
	20.0	30.0	49.9					None		0.1	100	120	0	100	100
	20.0	30.0	50.0					None		0.0	120	24	100	100	100
	17.5	26.3	43.8					None		12.5	120	24	0	100	0
	17.4	26.1	43.5					None		13.0	120	24	0	0	0
E50-E-Me	19.8	29.8	49.6					Methanol	0.8	0.0	100	24	0	100	100
	19.8	29.7	49.5						1.0	0.0	120	24	0	100	100
E50-E-EG	19.9	29.8	49.7					Ethylene glycol	0.7	0.0	100	24	0	100	100
	19.8	29.7	49.5						1.0	0.0	120	24	0	100	100
E50-E-MEK	19.2	28.8	48.0					Methyl ethyl ketone	4.0	0.0	100	24	0	100	100
	19.6	29.4	49.0						2.0	0.1	100	24	0	100	100
	18.8	28.2	47.0						6.0	0.0	120	24	0	100	100
	19.6	29.4	49.0						2.0	0.1	120	24	0	100	100
	19.9	29.8	49.7						0.4	0.2	120	24	0	100	100
	16.5	24.8	41.3						5.0	12.5	120	24	0	100	100
	16.0	24.0	40.0						7.0	13.0	120	24	0	100	0
E50-E-GE	18.8	28.2	47.0					Ethyl formate	6.0	0.0	100	24	0	100	100
	19.4	29.1	48.5						3.0	0.1	100	24	0	100	100
	18.0	27.0	45.0						10.0	0.0	120	24	0	100	100
	19.0	28.5	47.5						5.0	0.1	120	24	0	100	100
	19.6	29.3	48.9						2.0	0.2	120	24	0	100	100
	16.7	25.1	41.8						4.0	12.5	120	24	0	100	100
	16.2	24.3	40.5						6.0	13.0	120	24	0	100	0
E50-E-AA	19.4	29.1	48.5					Acetaldehyde	3.0	0.0	100	24	0	100	100
	19.7	29.5	49.2						1.5	0.1	100	24	0	100	100
	19.2	28.8	48.0						4.0	0.0	120	24	0	100	100
	19.6	29.4	49.0						2.0	0.1	120	24	0	100	100
	19.8	29.6	49.4						1.0	0.2	120	24	0	100	100
	17.1	25.7	42.8						2.0	12.5	120	24	0	100	100
	16.8	25.2	42.0						3.0	13.0	120	24	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 22

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
IN40-E	30.0	30.0			20.0	20.0		None		0.0	90	24	100	100	100
	30.0	30.0			19.9	20.0		None		0.1	90	24	0	100	100
	30.0	30.0			20.0	20.0		None		0.0	120	24	100	100	100
	28.4	28.4			18.9	18.9		None		5.5	120	24	0	100	0
	28.3	28.3			18.8	18.8		None		5.8	120	24	0	0	0
IN40-E-Me	29.8	29.8			19.8	19.8		Methanol	0.8	0.0	100	24	0	100	100
	29.8	29.8			19.9	19.9			0.4	0.2	100	24	0	100	100
	29.5	29.5			19.7	19.7			1.7	0.0	120	24	0	100	100
	29.6	29.6			19.8	19.8			1.0	0.2	120	24	0	100	100
	29.7	29.7			19.8	19.8			0.5	0.4	120	24	0	100	100
	28.1	28.1			18.7	18.7			1.0	5.5	120	24	0	100	100
	27.7	27.7			18.4	18.4			2.0	5.8	120	24	0	100	0
IN40-E-EG	29.6	29.6			19.7	19.7		Ethylene glycol	1.5	0.0	100	24	0	100	100
	29.6	29.6			19.8	19.8			1.0	0.2	100	24	0	100	100
	29.1	29.1			19.4	19.4			3.0	0.0	120	24	0	100	100
	29.3	29.3			19.6	19.6			2.0	0.2	120	24	0	100	100
	29.6	29.6			19.7	19.7			1.0	0.4	120	24	0	100	100
IN40-E-Ac	29.9	29.9			20.0	20.0		Acetone	0.2	0.0	100	24	0	100	100
	29.9	29.9			20.0	20.0			0.1	0.1	100	24	0	100	100
	29.9	29.9			20.0	20.0			0.2	0.0	120	24	0	100	100
	29.9	29.9			20.0	20.0			0.1	0.1	120	24	0	100	100
	27.8	27.8			18.5	18.5			2.0	5.5	120	24	0	100	100
	27.4	27.4			18.2	18.2			3.0	5.8	120	24	0	100	0
IN40-E-GM	29.6	29.6			19.7	19.7		Methyl formate	1.5	0.0	100	24	0	100	100
	29.7	29.7			19.8	19.8			0.8	0.1	100	24	0	100	100
	29.1	29.1			19.4	19.4			3.0	0.0	120	24	0	100	100
	29.6	29.6			19.8	19.8			1.0	0.2	120	24	0	100	100
	29.8	29.8			19.8	19.8			0.5	0.3	120	24	0	100	100
	27.8	27.8			18.5	18.5			2.0	5.5	120	24	0	100	100
	27.4	27.4			18.2	18.2			3.0	5.8	120	24	0	100	0
IN40-E-BA	29.9	29.9			19.9	19.9		Butylaldehyde	0.3	0.0	100	24	0	100	100
	29.9	29.9			19.9	19.9			0.2	0.1	100	24	0	100	100
	29.9	29.9			19.9	19.9			0.5	0.0	120	24	0	100	100
	29.9	29.9			19.9	19.9			0.2	0.1	120	24	0	100	100
	29.9	29.9			19.9	19.9			0.1	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 23

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
IN15-E	80.0	5.0			10	5		None		0.0	90	24	6	100	100
	79.9	5.0			10	5		None		0.1	90	24	0	100	100
	80.0	5.0			10.0	5.0		None		0.0	120	24	100	100	100
	79.5	5.0			9.9	5.0		None		0.6	120	24	0	100	0
	79.4	5.0			9.9	5.0		None		0.8	120	24	0	0	0
IN15-E-Me	79.6	5.0			10.0	5.0		Methanol	0.5	0.0	100	24	0	100	100
	79.6	5.0			10.0	5.0			0.3	0.2	100	24	0	100	100
	78.8	4.9			9.9	4.9			1.5	0.0	120	24	0	100	100
	79.2	5.0			9.9	5.0			0.8	0.2	120	24	0	100	100
	79.4	5.0			9.9	5.0			0.5	0.3	120	24	0	100	100
	79.1	4.9			9.9	4.9			0.5	0.6	120	24	0	100	100
	78.6	4.9			9.8	4.9			1.0	0.8	120	24	0	100	0
IN15-E-PG	78.4	4.9			9.8	4.9		Propylene glycol	2.0	0.0	100	24	0	100	100
	79.0	4.9			9.9	4.9			1.0	0.2	100	24	0	100	100
	76.8	4.8			9.6	4.8			4.0	0.0	120	24	0	100	100
	78.2	4.9			9.8	4.9			2.0	0.2	120	24	0	100	100
	78.9	4.9			9.9	4.9			1.0	0.4	120	24	0	100	100
IN15-E-MBK	79.8	5.0			10.0	5.0		Methyl isobutyl ketone	0.3	0.0	100	24	0	100	100
	79.8	5.0			10.0	5.0			0.2	0.1	100	24	0	100	100
	79.6	5.0			10.0	5.0			0.5	0.0	120	24	0	100	100
	79.8	5.0			10.0	5.0			0.2	0.1	120	24	0	100	100
	79.1	4.9			9.9	4.9			0.5	0.6	120	24	0	100	100
	78.6	4.9			9.8	4.9			1.0	0.8	120	24	0	100	0
IN15-E-GE	79.2	5.0			9.9	5.0		Ethyl formate	1.0	0.0	100	24	0	100	100
	79.4	5.0			9.9	5.0			0.6	0.1	100	24	0	100	100
	76.0	4.8			9.5	4.8			5.0	0.0	120	24	0	100	100
	78.2	4.9			9.8	4.9			2.0	0.2	120	24	0	100	100
	78.9	4.9			9.9	4.9			1.0	0.4	120	24	0	100	100
	76.3	4.8			9.5	4.8			4.0	0.6	120	24	0	100	100
	75.4	4.7			9.4	4.7			5.0	0.8	120	24	0	100	0
IN15-E-PA	79.8	5.0			10.0	5.0		Propion aldehyde	0.2	0.0	100	24	0	100	100
	79.8	5.0			10.0	5.0			0.1	0.1	100	24	0	100	100
	79.7	5.0			10.0	5.0			0.4	0.0	120	24	0	100	100
	79.8	5.0			10.0	5.0			0.2	0.1	120	24	0	100	100
	79.8	5.0			10.0	5.0			0.1	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 24

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether DBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
IN75-E	20.0	5.0			35	40		None		0.0	90	24	100	100	100
	20.0	5.0			35.0	39.9		None		0.1	90	24	100	100	100
	20.0	5.0			34.9	39.9		None		0.2	90	24	0	100	100
	20.0	5.0			35.0	40.0		None		0.0	120	24	100	100	100
	19.9	5.0			34.8	39.8		None		0.6	120	24	100	100	100
	19.8	5.0			34.7	39.7		None		0.8	120	24	0	100	100
IN75-E-Me	19.8	5.0			34.7	39.6		Methanol	1.0	0.0	100	24	0	100	100
	19.8	5.0			34.7	39.7			0.5	0.3	100	24	0	100	100
	19.6	4.9			34.3	39.2			2.0	0.0	120	24	0	100	100
	19.7	4.9			34.5	39.5			1.0	0.3	120	24	0	100	100
	19.8	5.0			34.7	39.6			0.5	0.5	120	24	0	100	100
IN75-E-EG	19.2	4.8			33.6	38.4		Ethylene glycol	4.0	0.0	100	24	0	100	100
	19.5	4.9			34.2	39.0			2.0	0.4	100	24	0	100	100
	18.8	4.7			32.9	37.6			6.0	0.0	120	24	0	100	100
	19.3	4.8			33.8	38.7			3.0	0.3	120	24	0	100	100
	19.6	4.9			34.3	39.2			1.5	0.5	120	24	0	100	100
IN75-E-MPK	20.0	5.0			34.9	39.9		Methyl-n-propyl ketone	0.2	0.0	100	24	0	100	100
	20.0	5.0			34.9	39.9			0.1	0.1	100	24	0	100	100
	20.0	5.0			34.9	39.9			0.2	0.0	120	24	0	100	100
	20.0	5.0			34.9	39.9			0.1	0.1	120	24	0	100	100
IN75-E-GE	19.6	4.9			34.3	39.2		Ethyl formate	2.0	0.0	100	24	0	100	100
	19.8	4.9			34.6	39.6			1.0	0.1	100	24	0	100	100
	19.3	4.8			33.8	38.6			3.5	0.0	120	24	0	100	100
	19.7	4.9			34.4	39.3			1.5	0.2	120	24	0	100	100
	19.8	4.9			34.6	39.6			0.8	0.3	120	24	0	100	100
IN75-E-AA	19.9	5.0			34.9	39.9		Acetaldehyde	0.3	0.0	100	24	0	100	100
	19.9	5.0			34.9	39.9			0.2	0.1	100	24	0	100	100
	19.9	5.0			34.8	39.8			0.6	0.0	120	24	0	100	100
	19.9	5.0			34.9	39.8			0.3	0.1	120	24	0	100	100
	19.9	5.0			34.9	39.8			0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 25

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol Ethanol	NPA	IPA	NBA	IBA	Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp 25° C	Low Temp. -10° C
EIB40-E	30.0	30.0	20.0				20.0	None		0.0	90	24	100	100	100
	30.0	29.9	20.0				20.0	None		0.1	90	24	0	100	100
	30.0	30.0	20.0				20.0	None		0.0	120	24	100	100	100
	27.9	27.9	18.6				18.6	None		6.9	120	24	0	100	0
	27.8	27.8	18.6				18.6	None		7.2	120	24	0	0	0
EIB40-E-Me	29.6	29.6	19.7				19.7	Methanol	1.5	0.0	100	24	0	100	100
	29.6	29.6	19.7				19.7		0.8	0.5	100	24	0	100	100
	29.4	29.4	19.6				19.6		2.0	0.0	120	24	0	100	100
	29.6	29.6	19.7				19.7		1.0	0.5	120	24	0	100	100
	29.6	29.6	19.7				19.7		0.5	1.0	120	24	0	100	100
EIB40-E-EG	29.7	29.7	19.8				19.8	Ethylene glycol	1.0	0.0	100	24	0	100	100
	29.7	29.7	19.8				19.8		0.7	0.4	100	24	0	100	100
	29.4	29.4	19.6				19.6		2.0	0.0	120	24	0	100	100
	29.5	29.5	19.6				19.6		1.5	0.3	120	24	0	100	100
	29.6	29.6	19.7				19.7		1.0	0.5	120	24	0	100	100
EIB40-E-Ac	29.9	29.9	20.0				20.0	Acetone	0.2	0.0	100	24	0	100	100
	29.9	29.9	20.0				20.0		0.1	0.1	100	24	0	100	100
	29.1	29.1	19.4				19.4		3.0	0.0	120	24	0	100	100
	29.6	29.6	19.8				19.8		1.0	0.2	120	24	0	100	100
	29.8	29.8	19.9				19.9		0.2	0.5	120	24	0	100	100
	27.0	27.0	18.0				18.0		3.0	6.9	120	24	0	100	100
	26.6	26.6	17.8				17.8		4.0	7.2	120	24	0	100	0
EIB40-E-GM	29.3	29.3	19.5				19.5	Methyl formate	2.5	0.0	100	24	0	100	100
	29.5	29.5	19.7				19.7		1.5	0.2	100	24	0	100	100
	28.5	28.5	19.0				19.0		5.0	0.0	120	24	0	100	100
	29.3	29.3	19.6				19.6		2.0	0.2	120	24	0	100	100
	29.6	29.6	19.7				19.7		1.0	0.5	120	24	0	100	100
	27.3	27.3	18.2				18.2		2.0	6.9	120	24	0	100	100
	26.9	26.9	18.0				18.0		3.0	7.2	120	24	0	100	0
EIB40-E-BA	29.8	29.8	19.9				19.9	Butylaldehyde	0.6	0.0	100	24	0	100	100
	29.8	29.8	19.9				19.9		0.1	0.5	100	24	0	100	100
	29.7	29.7	19.8				19.8		1.0	0.0	120	24	0	100	100
	29.8	29.8	19.9				19.9		0.2	0.5	120	24	0	100	100
	29.7	29.7	19.8				19.8		0.1	1.0	120	24	0	100	100
	27.6	27.6	18.4				18.4		1.0	6.9	120	24	0	100	100
	27.2	27.2	18.2				18.2		2.0	7.2	120	24	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 26

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether ETBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
EIB15-E	80.0	5.0	5.0				10.0	None		0.0	90	24	32	100	100
	79.9	5.0	5.0				10.0	None		0.1	90	24	0	100	100
	80.0	5.0	5.0				10.0	None		0.0	120	24	100	100	100
	79.5	5.0	5.0				9.9	None		0.6	120	24	0	100	0
	79.4	5.0	5.0				9.9	None		0.8	120	24	0	0	0
EIB15-E-Me	79.2	5.0	5.0				9.9	Methanol	1.0	0.0	100	24	0	100	100
	79.4	5.0	5.0				9.9		0.5	0.3	100	24	0	100	100
	78.8	4.9	4.9				9.9		1.5	0.0	120	24	0	100	100
	79.0	4.9	4.9				9.9		0.8	0.4	120	24	0	100	100
	79.0	4.9	4.9				9.9		0.6	0.6	120	24	0	100	100
	78.2	4.9	4.9				9.8		1.5	0.8	120	24	0	100	0
EIB15-E-PG	78.8	4.9	4.9				9.9	Propylene glycol	1.5	0.0	100	24	0	100	100
	79.2	5.0	5.0				9.9		0.8	0.2	100	24	0	100	100
	77.6	4.9	4.9				9.7		3.0	0.0	120	24	0	100	100
	78.2	4.9	4.9				9.8		2.0	0.3	120	24	0	100	100
	78.8	4.9	4.9				9.9		1.0	0.5	120	24	0	100	100
EIB15-E-DEK	79.2	5.0	5.0				9.9	Diethyl ketone	1.0	0.0	100	24	0	100	100
	79.6	5.0	5.0				10.0		0.4	0.1	100	24	0	100	100
	78.8	4.9	4.9				9.9		1.5	0.0	120	24	0	100	100
	79.4	5.0	5.0				9.9		0.7	0.1	120	24	0	100	100
	79.6	5.0	5.0				10.0		0.2	0.3	120	24	0	100	100
	77.5	4.8	4.8				9.7		2.5	0.6	120	24	0	100	100
	76.6	4.8	4.8				9.6		3.5	0.8	120	24	0	100	0
EIB15-E-GM	78.8	4.9	4.9				9.9	Methyl acetate	1.5	0.0	100	24	0	100	100
	79.0	4.9	4.9				9.9		1.0	0.2	100	24	0	100	100
	77.6	4.9	4.9				9.7		3.0	0.0	120	24	0	100	100
	79.0	4.9	4.9				9.9		1.0	0.2	120	24	0	100	100
	79.2	5.0	5.0				9.9		0.5	0.5	120	24	0	100	100
	78.2	4.9	4.9				9.8		1.7	0.6	120	24	0	100	100
	77.3	4.8	4.8				9.7		2.6	0.8	120	24	0	100	0
EIB15-E-PA	79.5	5.0	5.0				9.9	Propional aldehyde	0.6	0.0	100	24	0	100	100
	79.7	5.0	5.0				10.0		0.1	0.3	100	24	0	100	100
	79.2	5.0	5.0				9.9		1.0	0.0	120	24	0	100	100
	79.5	5.0	5.0				9.9		0.4	0.2	120	24	0	100	100
	79.5	5.0	5.0				9.9		0.2	0.4	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 27

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether DBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
EIB75	20.0	5.0	35.0				40.0	None		0.0	90	24	100	100	100
	20.0	5.0	35.0				39.9	None		0.1	90	24	100	100	100
	20.0	5.0	34.9				39.9	None		0.2	90	24	0	100	100
	20.0	5.0	35.0				40.0	None		0.0	120	24	100	100	100
	19.8	5.0	34.7				39.6	None		1.0	120	24	100	100	100
	19.8	4.9	34.6				39.5	None		1.2	120	24	0	100	100
EIB75-Me	19.7	4.9	34.5				39.4	Methanol	1.5	0.0	100	24	0	100	100
	19.7	4.9	34.5				39.4		1.0	0.5	100	24	0	100	100
	19.6	4.9	34.3				39.2		2.0	0.0	120	24	0	100	100
	19.6	4.9	34.3				39.2		1.5	0.5	120	24	0	100	100
	19.6	4.9	34.3				39.2		1.0	1.0	120	24	0	100	100
EIB75-E-EG	19.6	4.9	34.3				39.2	Ethylene glycol	2.0	0.0	100	24	0	100	100
	19.7	4.9	34.5				39.4		1.0	0.5	100	24	0	100	100
	20.0	5.0	35.0				40.0								
	19.2	4.8	33.6				38.4		4.0	0.0	120	24	0	100	100
	19.3	4.8	33.8				38.6		3.0	0.5	120	24	0	100	100
	19.4	4.9	34.0				38.8		2.0	1.0	120	24	0	100	100
EIB75-MEK	19.4	4.9	34.0				38.8	Methyl ethyl ketone	3.0	0.0	100	24	0	100	100
	19.9	5.0	34.8				39.8		0.3	0.3	100	24	0	100	100
	19.0	4.8	33.3				38.0		5.0	0.0	120	24	0	100	100
	19.6	4.9	34.2				39.1		2.0	0.2	120	24	0	100	100
	19.8	4.9	34.6				39.5		0.2	1.0	120	24	0	100	100
EIB75-E-GM	19.2	4.8	33.6				38.4	Methyl formate	4.0	0.0	100	24	0	100	100
	19.5	4.9	34.2				39.1		2.0	0.3	100	24	0	100	100
	18.4	4.6	32.2				36.8		8.0	0.0	120	24	0	100	100
	19.1	4.8	33.5				38.3		4.0	0.3	120	24	0	100	100
	19.4	4.9	34.0				38.8		2.0	1.0	120	24	0	100	100
EIB75-AA	19.8	5.0	34.7				39.7	Acetaldehyde	0.8	0.0	100	24	0	100	100
	19.9	5.0	34.8				39.8		0.2	0.3	100	24	0	100	100
	19.8	5.0	34.7				39.6		1.0	0.0	120	24	0	100	100
	19.9	5.0	34.8				39.7		0.4	0.3	120	24	0	100	100
	19.9	5.0	34.8				39.7		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 28

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC	Ether	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fue (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	MTBE	Ethanol	NPA	IPA	NBA	IBA								
PNB30-E	40.0	30.0			10.0	10.0	10.0	None		0.0	80	120	15	100	100
	39.9	30.0			10.0	10.0	10.0	None		0.1	80	120	0	100	100
	40.0	30.0			10.0	10.0	10.0	None		0.0	120	24	100	100	100
	38.9	29.2			9.7	9.7	9.7	None		2.7	120	24	0	100	0
	38.8	29.1			9.7	9.7	9.7	None		3.0	120	24	0	0	0
PNB30-E-Me	39.6	29.7			9.9	9.9	9.9	Methanol	1.0	0.0	100	24	0	100	100
	39.7	29.8			9.9	9.9	9.9		0.4	0.3	100	24	0	100	100
	39.4	29.6			9.9	9.9	9.9		1.5	0.0	120	24	0	100	100
	39.5	29.6			9.9	9.9	9.9		1.0	0.2	120	24	0	100	100
	39.7	29.8			9.9	9.9	9.9		0.5	0.3	120	24	0	100	100
	38.5	28.9			9.6	9.6	9.6		1.0	2.7	120	24	0	100	100
	38.0	28.5			9.5	9.5	9.5		2.0	3.0	120	24	0	100	0
PNB30-E-EG	39.2	29.4			9.8	9.8	9.8	Ethylene glycol	2.0	0.0	100	24	0	100	100
	39.5	29.6			9.9	9.9	9.9		1.0	0.2	100	24	0	100	100
	39.0	29.3			9.8	9.8	9.8		2.5	0.0	120	24	0	100	100
	39.3	29.5			9.8	9.8	9.8		1.5	0.2	120	24	0	100	100
	39.5	29.6			9.9	9.9	9.9		1.0	0.3	120	24	0	100	100
PNB30-E-Ac	39.9	29.9			10.0	10.0	10.0	Acetone	0.2	0.0	100	24	0	100	100
	39.9	29.9			10.0	10.0	10.0		0.1	0.1	100	24	0	100	100
	39.9	29.9			10.0	10.0	10.0		0.2	0.0	120	24	0	100	100
	39.9	29.9			10.0	10.0	10.0		0.1	0.1	120	24	0	100	100
	38.1	28.6			9.5	9.5	9.5		2.0	2.7	120	24	0	100	100
	37.6	28.2			9.4	9.4	9.4		3.0	3.0	120	24	0	100	0
PNB30-E-GM	39.4	29.6			9.9	9.9	9.9	Methyl formate	1.5	0.0	100	24	0	100	100
	39.5	29.6			9.9	9.9	9.9		1.0	0.2	100	24	0	100	100
	39.0	29.3			9.8	9.8	9.8		2.5	0.0	120	24	0	100	100
	39.3	29.5			9.8	9.8	9.8		1.5	0.2	120	24	0	100	100
	39.6	29.7			9.9	9.9	9.9		0.6	0.3	120	24	0	100	100
	37.7	28.3			9.4	9.4	9.4		3.0	2.7	120	24	0	100	100
	37.0	27.8			9.3	9.3	9.3		4.5	3.0	120	24	0	100	0
PNB30-E-BA	39.8	29.9			10.0	10.0	10.0	Butylaldehyde	0.4	0.0	100	24	0	100	100
	39.9	29.9			10.0	10.0	10.0		0.1	0.2	100	24	0	100	100
	39.8	29.9			10.0	10.0	10.0		0.5	0.0	120	24	0	100	100
	39.8	29.9			10.0	10.0	10.0		0.2	0.3	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 29

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether DBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
PNB15-E	80.0	5.0			5.0	5.0	5.0	None		0.0	80	120	3	100	100
	79.9	5.0			5.0	5.0	5.0	None		0.1	80	120	0	100	100
	80.0	5.0			5.0	5.0	5.0	None		0.0	120	24	100	100	100
	79.6	5.0			5.0	5.0	5.0	None		0.5	120	24	0	100	0
	79.4	5.0			5.0	5.0	5.0	None		0.7	120	24	0	0	0
PNB15-E-Me	79.4	5.0			5.0	5.0	5.0	Methanol	0.8	0.0	100	24	0	100	100
	79.5	5.0			5.0	5.0	5.0		0.4	0.2	100	24	0	100	100
	78.8	4.9			4.9	4.9	4.9		1.5	0.0	120	24	0	100	100
	79.0	4.9			4.9	4.9	4.9		1.0	0.2	120	24	0	100	100
	79.4	5.0			5.0	5.0	5.0		0.5	0.3	120	24	0	100	100
	78.0	4.9			4.9	4.9	4.9		2.0	0.5	120	24	0	100	100
	77.0	4.8			4.8	4.8	4.8		3.0	0.7	120	24	0	100	0
PNB15-E-PG	77.6	4.9			4.9	4.9	4.9	Propylene glycol	3.0	0.0	100	24	0	100	100
	78.6	4.9			4.9	4.9	4.9		1.5	0.2	100	24	0	100	100
	76.8	4.8			4.8	4.8	4.8		4.0	0.0	120	24	0	100	100
	78.2	4.9			4.9	4.9	4.9		2.0	0.2	120	24	0	100	100
	79.0	4.9			4.9	4.9	4.9		1.0	0.3	120	24	0	100	100
PNB15-E-MPK	79.8	5.0			5.0	5.0	5.0	Methyl-n-propyl ketone	0.3	0.0	100	24	0	100	100
	79.8	5.0			5.0	5.0	5.0		0.2	0.1	100	24	0	100	100
	79.6	5.0			5.0	5.0	5.0		0.5	0.0	120	24	0	100	100
	79.7	5.0			5.0	5.0	5.0		0.2	0.2	120	24	0	100	100
	76.4	4.8			4.8	4.8	4.8		4.0	0.5	120	24	0	100	100
	75.4	4.7			4.7	4.7	4.7		5.0	0.7	120	24	0	100	0
PNB15-E-SM	78.8	4.9			4.9	4.9	4.9	Methyl acetate	1.5	0.0	100	24	0	100	100
	79.0	4.9			4.9	4.9	4.9		1.0	0.2	100	24	0	100	100
	75.2	4.7			4.7	4.7	4.7		6.0	0.0	120	24	0	100	100
	77.4	4.8			4.8	4.8	4.8		3.0	0.2	120	24	0	100	100
	79.0	4.9			4.9	4.9	4.9		1.0	0.3	120	24	0	100	100
	74.8	4.7			4.7	4.7	4.7		6.0	0.5	120	24	0	100	100
	73.8	4.6			4.6	4.6	4.6		7.0	0.7	120	24	0	100	0
PNB15-E-AA	79.8	5.0			5.0	5.0	5.0	Acetaldehyde	0.3	0.0	100	24	0	100	100
	79.8	5.0			5.0	5.0	5.0		0.2	0.1	100	24	0	100	100
	79.6	5.0			5.0	5.0	5.0		0.5	0.0	120	24	0	100	100
	79.7	5.0			5.0	5.0	5.0		0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 30

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether ETBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA								
PNB75-E	20.0	5.0			25.0	25.0	25.0	None		0.0	80	120	100	100	100
	20.0	5.0			24.9	25.0	25.0	None		0.1	80	120	92	100	100
	20.0	5.0			24.9	24.9	25.0	None		0.2	80	120	0	100	100
	20.0	5.0			25.0	25.0	25.0	None		0.0	120	24	100	100	100
	17.7	4.4			22.1	22.1	22.1	None		11.7	120	24	0	100	0
	17.6	4.4			22.0	22.0	22.0	None		12.1	120	24	0	0	0
PNB75-E-Me	19.8	5.0			24.8	24.8	24.8	Methanol	1.0	0.0	100	24	0	100	100
	19.9	5.0			24.8	24.8	24.8		0.4	0.3	100	24	0	100	100
	19.6	4.9			24.5	24.5	24.5		2.0	0.0	120	24	0	100	100
	19.7	4.9			24.6	24.6	24.6		1.5	0.2	120	24	0	100	100
	19.8	4.9			24.7	24.7	24.7		0.8	0.4	120	24	0	100	100
	17.3	4.3			21.6	21.6	21.6		2.0	11.7	120	24	0	100	100
	17.0	4.2			21.2	21.2	21.2		3.0	12.1	120	24	0	100	0
PNB75-E-EG	19.2	4.8			24.0	24.0	24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100
	19.6	4.9			24.6	24.6	24.6		1.5	0.3	100	24	0	100	100
	19.0	4.8			23.8	23.8	23.8		5.0	0.0	120	24	0	100	100
	19.3	4.8			24.2	24.2	24.2		3.0	0.3	120	24	0	100	100
	19.6	4.9			24.5	24.5	24.5		1.5	0.5	120	24	0	100	100
PNB75-E-MEK	19.9	5.0			24.9	24.9	24.9	Methyl ethyl ketone	0.3	0.0	100	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.1	0.2	100	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.5	0.0	120	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.2	0.2	120	24	0	100	100
	17.1	4.3			21.3	21.3	21.3		3.0	11.7	120	24	0	100	100
	16.8	4.2			21.0	21.0	21.0		4.0	12.1	120	24	0	100	0
PNB75-E-GE	19.2	4.8			24.0	24.0	24.0	Ethyl formate	4.0	0.0	100	24	0	100	100
	19.6	4.9			24.5	24.5	24.5		2.0	0.2	100	24	0	100	100
	18.8	4.7			23.5	23.5	23.5		6.0	0.0	120	24	0	100	100
	19.4	4.8			24.2	24.2	24.2		3.0	0.2	120	24	0	100	100
	19.7	4.9			24.7	24.7	24.7		1.0	0.4	120	24	0	100	100
	16.9	4.2			21.1	21.1	21.1		4.0	11.7	120	24	0	100	100
	16.6	4.1			20.7	20.7	20.7		5.0	12.1	120	24	0	100	0
PNB75-E-PA	19.9	5.0			24.9	24.9	24.9	Propion aldehyde	0.3	0.0	100	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.1	0.2	100	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.5	0.0	120	24	0	100	100
	19.9	5.0			24.9	24.9	24.9		0.2	0.2	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 31

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA									
EIPP30-E	40.0	30.0	10.0		10.0		10.0	None		0.0	80	120	64	100	100
	39.9	30.0	10.0		10.0		10.0	None		0.1	80	120	0	100	100
	40.0	30.0	10.0		10.0		10.0	None		0.0	120	24	100	100	100
	38.4	28.8	9.6		9.6		9.6	None		3.9	120	24	0	100	0
	38.3	28.7	9.6		9.6		9.6	None		4.2	120	24	0	0	0
EIPP30-E-Me	39.4	29.6	9.9		9.9		9.9	Methanol	1.5	0.0	100	24	0	100	100
	39.6	29.7	9.9		9.9		9.9		0.5	0.4	100	24	0	100	100
	39.0	29.3	9.8		9.8		9.8		2.5	0.0	120	24	0	100	100
	39.2	29.4	9.8		9.8		9.8		1.5	0.5	120	24	0	100	100
	39.4	29.6	9.9		9.9		9.9		0.5	1.0	120	24	0	100	100
EIPP30-E-EG	39.2	29.4	9.8		9.8		9.8	Ethylene glycol	2.0	0.0	100	24	0	100	100
	39.4	29.6	9.9		9.9		9.9		1.0	0.4	100	24	0	100	100
	38.0	28.5	9.5		9.5		9.5		5.0	0.0	120	24	0	100	100
	38.6	28.9	9.6		9.6		9.6		3.0	0.6	120	24	0	100	100
	38.8	29.1	9.7		9.7		9.7		2.0	1.0	120	24	0	100	100
EIPP30-E-Ac	38.8	29.1	9.7		9.7		9.7	Acetone	3.0	0.0	100	24	0	100	100
	39.8	29.9	10.0		10.0		10.0		0.2	0.3	100	24	0	100	100
	38.4	28.8	9.6		9.6		9.6		4.0	0.0	120	24	0	100	100
	39.5	29.6	9.9		9.9		9.9		1.0	0.2	120	24	0	100	100
									0.2	0.5	120	24	0	100	100
	36.0	27.0	9.0		9.0		9.0		6.0	3.9	120	24	0	100	100
	35.5	26.6	8.9		8.9		8.9		7.0	4.2	120	24	0	100	0
EIPP30-E-GM	39.4	29.6	9.9		9.9		9.9	Methyl formate	1.5	0.0	100	24	0	100	100
	39.5	29.6	9.9		9.9		9.9		1.0	0.2	100	24	0	100	100
	37.6	28.2	9.4		9.4		9.4		6.0	0.0	120	24	0	100	100
	39.4	29.6	9.9		9.9		9.9		1.0	0.5	120	24	0	100	100
	39.5	29.6	9.9		9.9		9.9		0.2	1.0	120	24	0	100	100
	35.6	26.7	8.9		8.9		8.9		7.0	3.9	120	24	0	100	100
	35.1	26.3	8.8		8.8		8.8		8.0	4.2	120	24	0	100	0
EIPP30-E-BA	39.8	29.8	9.9		9.9		9.9	Butylaldehyde	0.6	0.0	100	24	0	100	100
	39.8	29.9	10.0		10.0		10.0		0.2	0.3	100	24	0	100	100
	39.6	29.7	9.9		9.9		9.9		1.0	0.0	120	24	0	100	100
	39.7	29.8	9.9		9.9		9.9		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 32

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether DBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA									
EIPP15-E	80.0	5.0	5.0		5.0		5.0	None		0.0	80	120	9	100	100
	79.9	5.0	5.0		5.0		5.0	None		0.1	80	120	0	100	100
	80.0	5.0	5.0		5.0		5.0	None		0.0	120	24	100	100	100
	79.4	5.0	5.0		5.0		5.0	None		0.8	120	24	0	100	0
	79.2	5.0	5.0		5.0		5.0	None		1.0	120	24	0	0	0
EIPP15-E-Me	79.2	5.0	5.0		5.0		5.0	Methanol	1.0	0.0	100	24	0	100	100
	79.3	5.0	5.0		5.0		5.0		0.5	0.4	100	24	0	100	100
	78.4	4.9	4.9		4.9		4.9		2.0	0.0	120	24	0	100	100
	78.9	4.9	4.9		4.9		4.9		1.0	0.4	120	24	0	100	100
	79.1	4.9	4.9		4.9		4.9		0.5	0.6	120	24	0	100	100
EIPP15-E-PG	78.0	4.9	4.9		4.9		4.9	Propylene glycol	2.5	0.0	100	24	0	100	100
	78.6	4.9	4.9		4.9		4.9		1.5	0.3	100	24	0	100	100
	76.8	4.8	4.8		4.8		4.8		4.0	0.0	120	24	0	100	100
	78.1	4.9	4.9		4.9		4.9		2.0	0.4	120	24	0	100	100
	78.4	4.9	4.9		4.9		4.9		1.5	0.5	120	24	0	100	100
EIPP15-E-DEK	78.4	4.9	4.9		4.9		4.9	Diethyl ketone	2.0	0.0	100	24	0	100	100
	79.6	5.0	5.0		5.0		5.0		0.2	0.3	100	24	0	100	100
	77.6	4.9	4.9		4.9		4.9		3.0	0.0	120	24	0	100	100
	79.2	5.0	5.0		5.0		5.0		0.8	0.2	120	24	0	100	100
									0.2	0.5					
	76.2	4.8	4.8		4.8		4.8		4.0	0.8	120	24	0	100	100
	75.2	4.7	4.7		4.7		4.7		5.0	1.0	120	24	0	100	0
EIPP15-E-SM	79.0	4.9	4.9		4.9		4.9	Methyl acetate	1.2	0.0	100	24	0	100	100
	79.2	5.0	5.0		5.0		5.0		0.8	0.2	100	24	0	100	100
	77.2	4.8	4.8		4.8		4.8		3.5	0.0	120	24	0	100	100
	78.2	4.9	4.9		4.9		4.9		2.0	0.2	120	24	0	100	100
	78.8	4.9	4.9		4.9		4.9		1.0	0.5	120	24	0	100	100
	75.4	4.7	4.7		4.7		4.7		5.0	0.8	120	24	0	100	100
	74.4	4.7	4.7		4.7		4.7		6.0	1.0	120	24	0	100	0
EIPP15-E-PA	79.6	5.0	5.0		5.0		5.0	Propion aldehyde	0.5	0.0	100	24	0	100	100
	79.6	5.0	5.0		5.0		5.0		0.2	0.3	100	24	0	100	100
	79.4	5.0	5.0		5.0		5.0		0.8	0.0	120	24	0	100	100
	79.5	5.0	5.0		5.0		5.0		0.2	0.4	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 33

Designation of Formulation	Fuel Composition (wt%)							Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Ether ETBE	Alcohol					Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp.(°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA									
EIPP75-E	20.0	5.0	25.0		25.0		25.0	None		0.0	80	120	100	100	100
	20.0	5.0	24.9		25.0		25.0	None		0.1	80	120	100	100	100
	20.0	5.0	24.9		24.9		25.0	None		0.2	80	120	0	100	100
	20.0	5.0	25.0		25.0		25.0	None		0.0	120	24	100	100	100
	19.7	4.9	24.6		24.6		24.6	None		1.5	120	24	100	100	100
	19.7	4.9	24.6		24.6		24.6	None		1.7	120	24	0	100	100
EIPP75-E-Me	19.6	4.9	24.5		24.5		24.5	Methanol	2.0	0.0	100	24	0	100	100
	19.7	4.9	24.6		24.6		24.6		1.0	0.5	100	24	0	100	100
	19.4	4.9	24.3		24.3		24.3		3.0	0.0	120	24	0	100	100
	19.5	4.9	24.4		24.4		24.4		2.0	0.5	120	24	0	100	100
	19.7	4.9	24.6		24.6		24.6		0.6	1.0	120	24	0	100	100
EIPP75-E-EG	19.2	4.8	24.0		24.0		24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100
	19.5	4.9	24.4		24.4		24.4		2.0	0.5	100	24	0	100	100
	18.0	4.5	22.5		22.5		22.5		10.0	0.0	120	24	0	100	100
	18.7	4.7	23.4		23.4		23.4		6.0	0.5	120	24	0	100	100
	19.2	4.8	24.0		24.0		24.0		3.0	1.0	120	24	0	100	100
EIPP75-E-MEK	19.4	4.9	24.3		24.3		24.3	Methyl ethyl ketone	3.0	0.0	100	24	0	100	100
	19.9	5.0	24.9		24.9		24.9		0.2	0.3	100	24	0	100	100
	19.0	4.8	23.8		23.8		23.8		5.0	0.0	120	24	0	100	100
	19.8	4.9	24.7		24.7		24.7		1.0	0.2	120	24	0	100	100
EIPP75-E-GM	19.4	4.9	24.3		24.3		24.3	Methyl formate	3.0	0.0	100	24	0	100	100
	19.5	4.9	24.4		24.4		24.4		2.0	0.3	100	24	0	100	100
	18.0	4.5	22.5		22.5		22.5		10.0	0.0	120	24	0	100	100
	19.1	4.8	23.9		23.9		23.9		4.0	0.5	120	24	0	100	100
	19.4	4.9	24.3		24.3		24.3		2.0	1.0	120	24	0	100	100
EIPP75-E-AA	19.9	5.0	24.9		24.9		24.9	Acetaldehyde	0.5	0.0	100	24	0	100	100
	19.9	5.0	24.9		24.9		24.9		0.2	0.2	100	24	0	100	100
	19.8	5.0	24.8		24.8		24.8		1.0	0.0	120	24	0	100	100
	19.9	5.0	24.8		24.8		24.8		0.2	0.5	120	24	0	100	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 34

Designation of Formulation	Fuel Composition (wt%)				Additive		Water	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Alcohol			Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
		Ethanol	NPA	IPA								
E2	98.0	2.0			None		0.0	120	120	1	100	100
	97.9	2.0			None		0.1	120	120	0	100	100
	97.8	2.0			None		0.2	120	120	0	100	0
	97.6	2.0			None		0.4	120	120	0	0	0
E2-Me	97.5	2.0			Methanol	0.5	0.0	120	120	0	100	100
E2-EG	97.5	2.0			Ethylene glycol	0.5	0.0	120	120	0	100	100
E2-Ac	96.0	2.0			Acetone	2.0	0.0	120	120	0	100	100
	96.9	2.0				1.0	0.1	120	120	0	100	100
	95.8	2.0				2.0	0.2	120	120	0	100	100
	94.7	1.9				3.0	0.4	120	120	0	100	0
E2-GE	96.0	2.0			Ethyl formate	2.0	0.0	120	120	0	100	100
	96.4	2.0				1.5	0.1	120	120	0	100	100
	93.9	1.9				4.0	0.2	120	120	0	100	100
	92.7	1.9				5.0	0.4	120	120	0	100	0
E2-BA	96.5	2.0			Butylaldehyde	1.5	0.0	120	120	0	100	100
	96.9	2.0				1.0	0.1	120	120	0	100	100
	94.9	1.9				3.0	0.2	120	120	0	100	100
	93.7	1.9				4.0	0.4	120	120	0	100	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 35

< Ether Nonloaded Type >

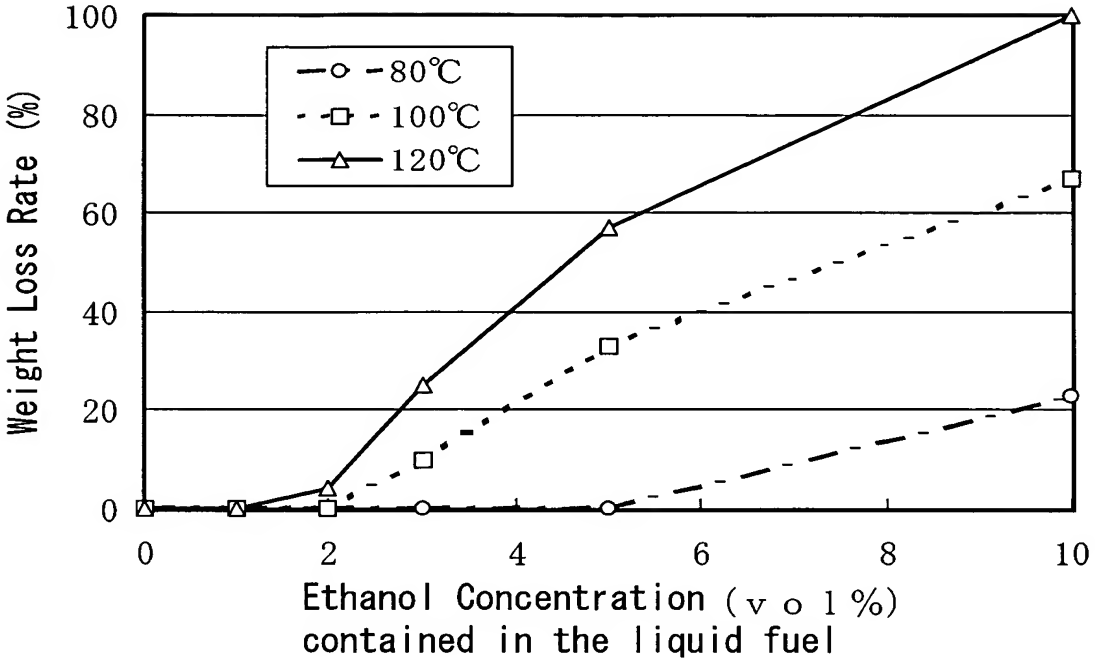
Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water	Methanol			Glycols			Ketones			Esters			Aldehydes		
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E2	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E10	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E20	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E50	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
IN40	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
EIB40	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
EIB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIB75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
PNB30	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB75	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIPP30	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP15	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

< Ether loaded Type >

Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water	Methanol			Glycols			Ketones			Esters			Aldehydes		
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E10-E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E20-E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E50-E	○	○	-		○	-	-	○	○	○	○	○	○	○	○	○
IN40-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN75-E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
EIB40-E	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
EIB15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIB75-E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
PNB30-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB75-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIPP30-	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP15-	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP75-	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

2005

Fig. 36



Treatment Time 240Hr

Ethanol Concentration (vol.1%)		0	1	2	3	5	10
Weight Loss Rate (%)	80℃	0	0	0	0	0	23
	100℃	0	0	0	10	33	67
	120℃	0	0	4	25	57	100

Fig. 37

Designation of Formulation	Fuel Composition (wt%)						Water	Aluminum Corrosion Test		
	HC Naphtha	Alcohol					Loading/Fuel (wt%)	Evaluation Temp. (℃)	Evaluation Time (hr)	Weight Loss Rate (%)
		Ethanol	NPA	IPA	NBA	IBA				
IPB75	25.0			35.0		40.0	0.00	100	24	100
	25.0			35.0		39.9	0.10	100	24	58
	25.0			34.9		39.9	0.15	100	24	0
	25.0			35.0		40.0	0.00	120	24	100
	25.0			34.9		39.9	0.15	120	24	100
	24.9			34.9		39.9	0.30	120	24	0